IEA Bioenergy Technology Collaboration Programme

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Chair IEA Bioenergy

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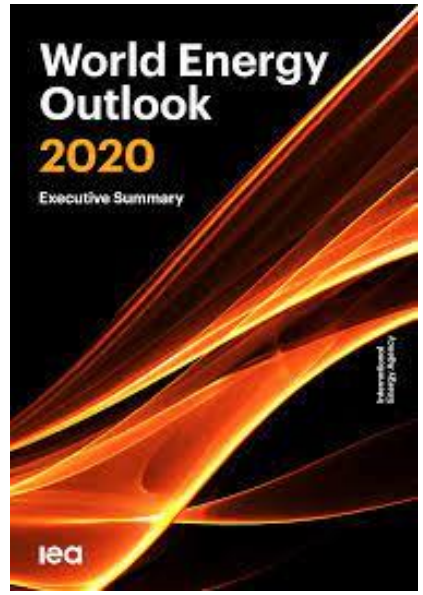
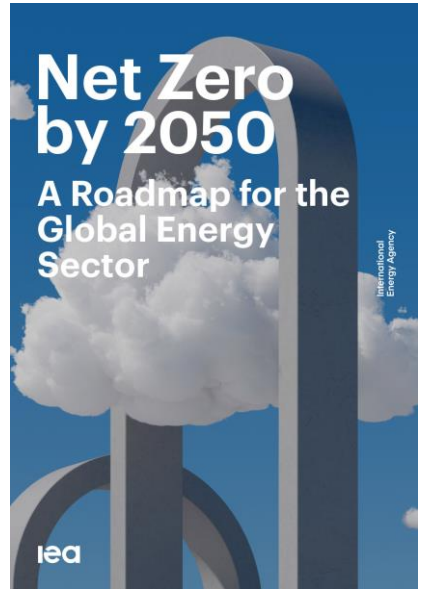
International Energy Agency https://www.iea.org

Mission: The IEA is committed to shaping a secure and sustainable energy future for all,

- 31 Member Countries – including New Zealand
  - And 10 Association Countries
- Data, Analysis and Policy Recommendations
- It is technology agnostic, and has Technology Collaboration Programmes on a range of energy renewable technologies, incl Bioenergy, H2, PVs, Hydro, Solar etc.
  - But also have TCPs on Fossil Energy, Power, Transport, Buildings etc



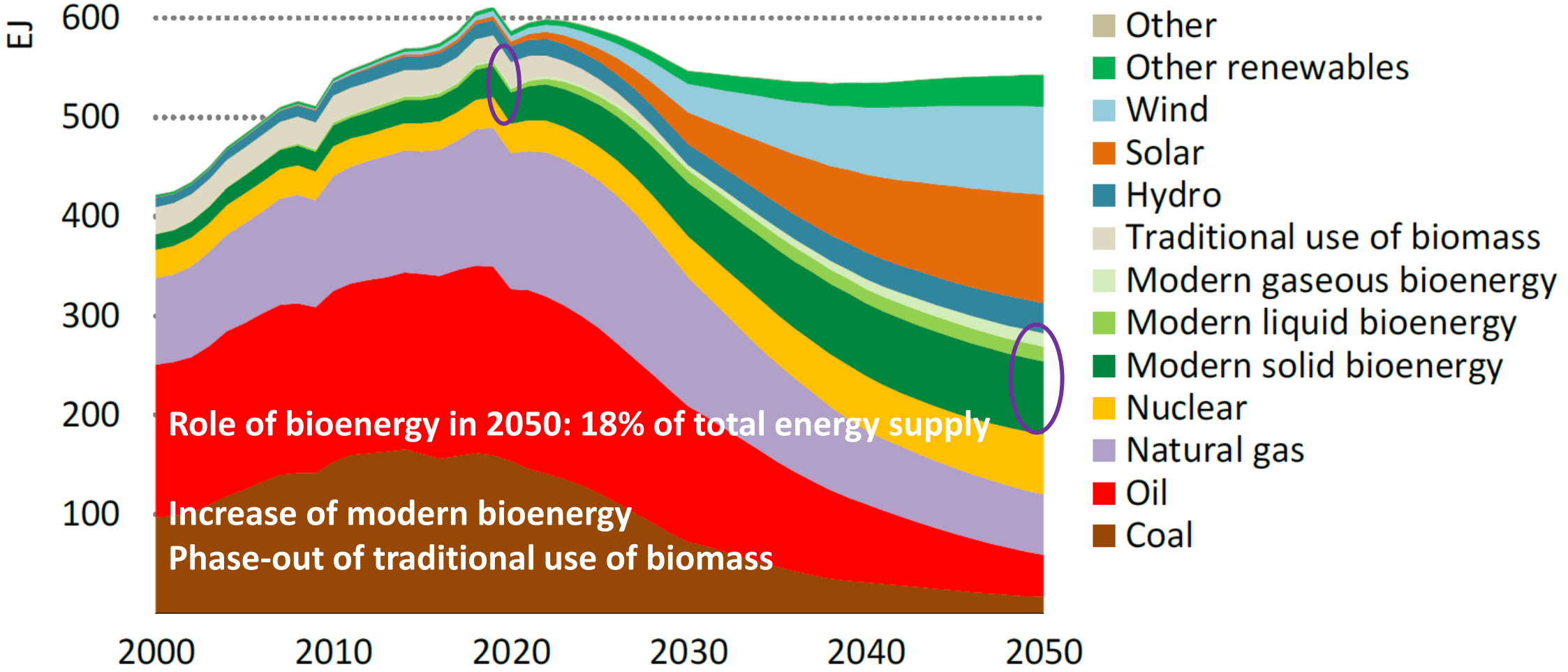


Net Zero by 2050

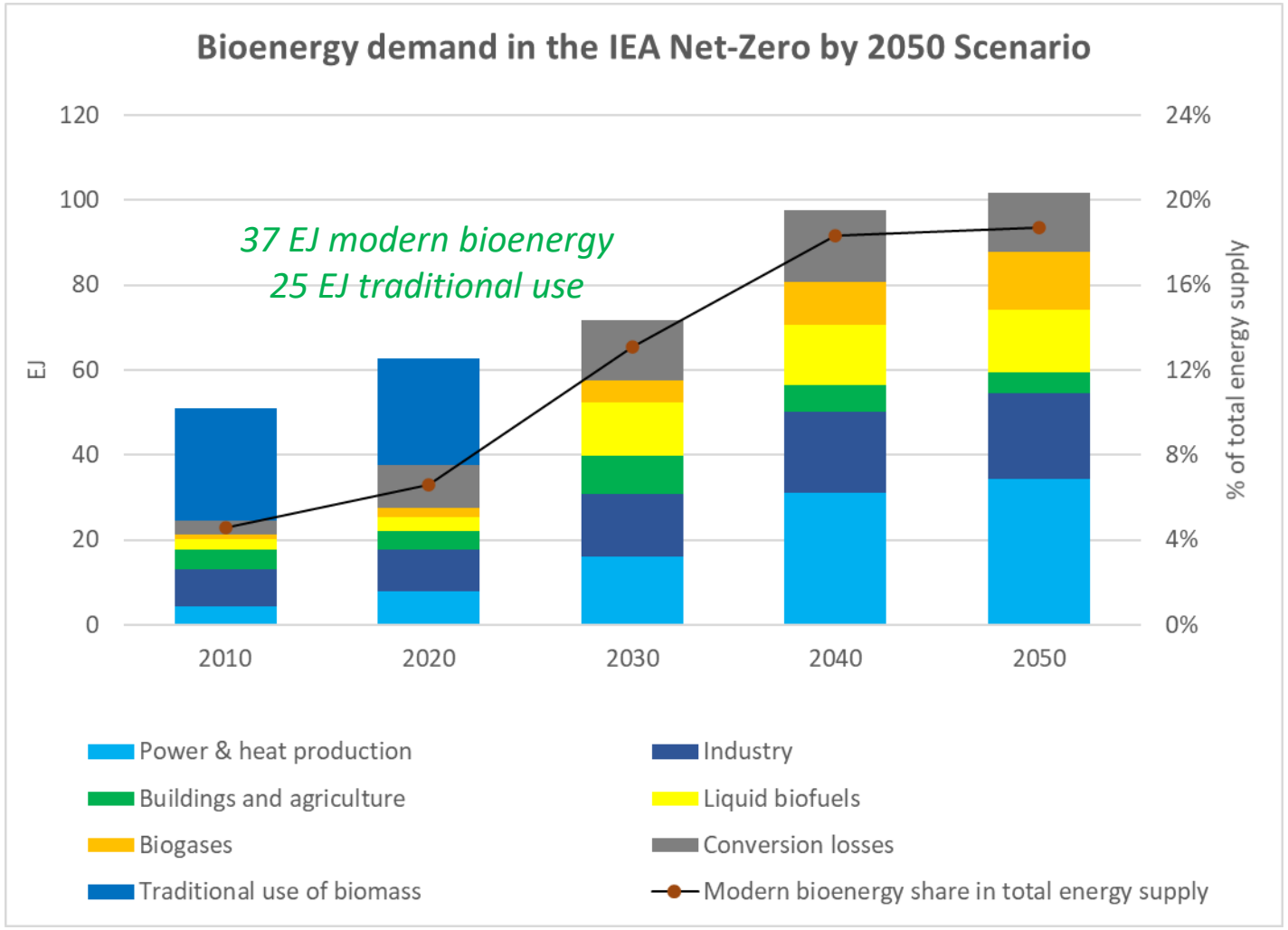
Is there a long term role for bioenergy?

- **Important roles** in pathways keeping global warming below 1.5/2°C
- **No silver bullets but mix of options** including energy conservation and efficiency measures, bioenergy and other renewables, and carbon dioxide removal (CDR) options.
- Particularly relevant in **hard-to-abate sectors** (e.g., aviation, maritime transport, industry heat) and in association with CDR (BECCS) to counteract residual GHG emissions
- Biomass use for energy **needs to be balanced** with provision of food and biomass for bio-based products.
- Nevertheless, there are **limits to biomass & land availability** and rapid expansion is challenging due to trade-offs (*not unique for bioenergy*).

Role of bioenergy in IEA Roadmap Net-Zero-by-2050 (2021) – total energy supply



IEA NZE roadmap: Focus on Bioenergy



IEA (2021), Net Zero by 2050

- Traditional use of biomass to phase out
- modern bioenergy to triple from today's levels
- Modern bioenergy is used to directly **replace fossil fuels** or to **offset emissions** indirectly through its combined use with CCUS

Multiple sources of biomass

Most debated

Organic residues and waste

- Industrial residues & waste
  - From agro-food processing
  - From wood processing
- Agriculture and forestry residues
  - Crop harvesting residues
  - Livestock residues
  - Wood harvesting residues
- Municipal waste (organic fraction)
  - Household waste & wastewaters
  - Material waste (e.g. post consumer wood)
  - Residues from landscape management

Forestry

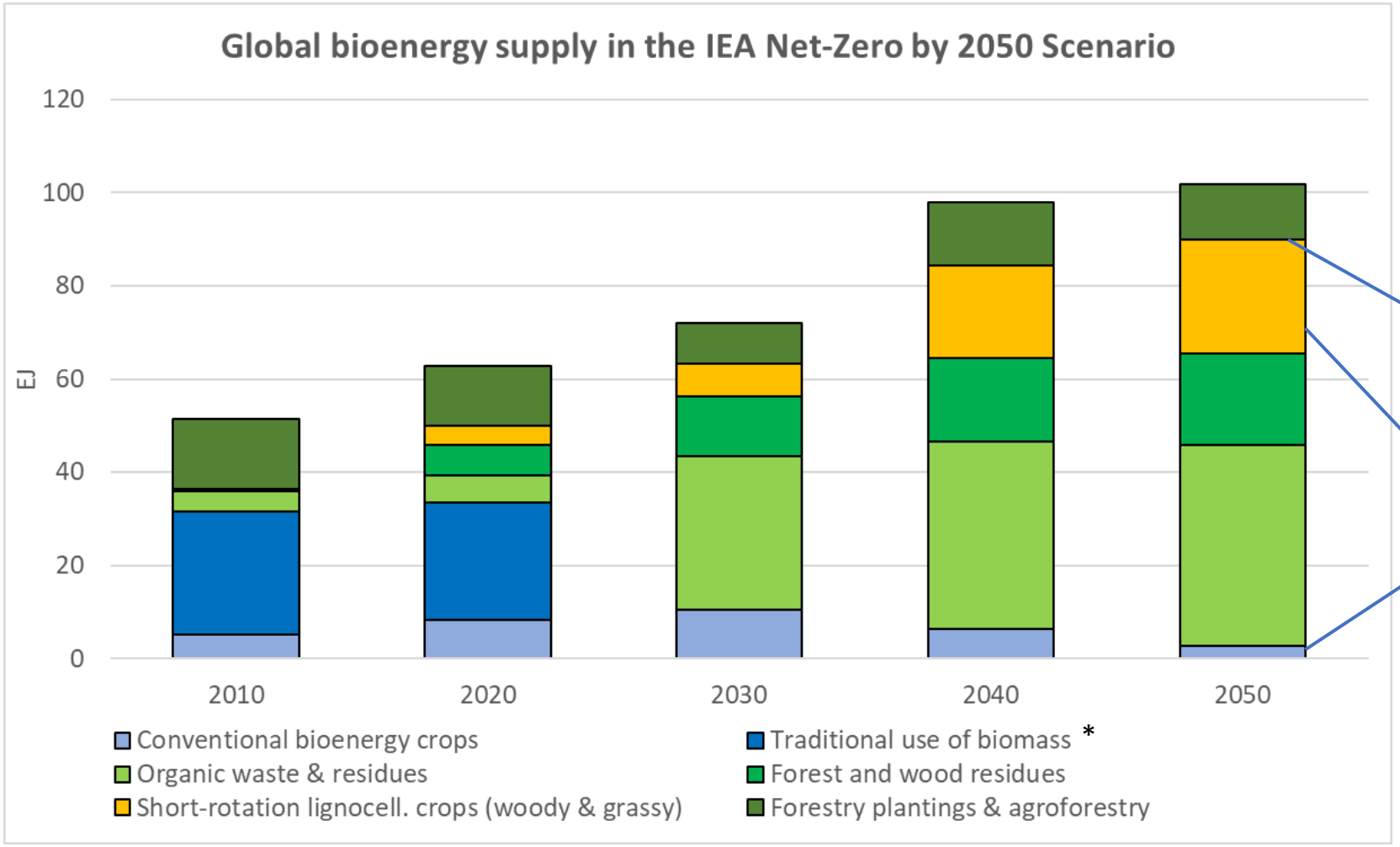
- Sustainable harvests from natural & semi-natural forests
- Harvests from forest plantations

Agriculture

- Sugar, starch and oilseed crops
- Lignocellulosic crops and short rotation coppice
- Aquaculture (algae)

Source: IEA ETP 2017

Biomass use in IEA NZE2050



Overall limit **100 EJ** (*to be on the safe side*)

60 EJ from agri, forestry & industry residues & wastes

40 EJ requiring land use

- New sustainably managed forestry plantations & agroforestry
- Short rotation lignocell. crops
- Conventional bioenergy crops (declining)
- 140 Mha land use for bioenergy crops (70 Mha marginal lands – 70 Mha croplands *~current use for biofuels*)

Data source: International Energy Agency (2021), Net Zero by 2050

**Some of the resources now used in 'traditional way' can be available for modern use if sustainability principles are respected.*

IEA sees a unique role for sustainable bioenergy in the transition away from fossil energy

- **Available now** to phase out fossil fuels in existing energy infrastructure
- **Versatile**: role in different sectors – heat, power, transport fuels
- **Storable/dispatchable:** complements intermittent/seasonal renewables in power systems
- Uniquely, it can **remove atmospheric CO_2** ("negative emissions") via deployment of Carbon Capture & Storage (CCS) : BECCS / Bio-CCS

Bioenergy contributes to *climate change mitigation* when:

- Biomass is grown **sustainably** or based on waste/residues
- **Converted** to energy products **efficiently** (often together with other biobased products)
- Used to **displace fossil fuels**

IEA Bioenergy TCP

IEA Bioenergy is a Technology Collaboration Programme (TCP)

Organised under the auspices of the International Energy Agency (IEA) but is functionally and legally autonomous.

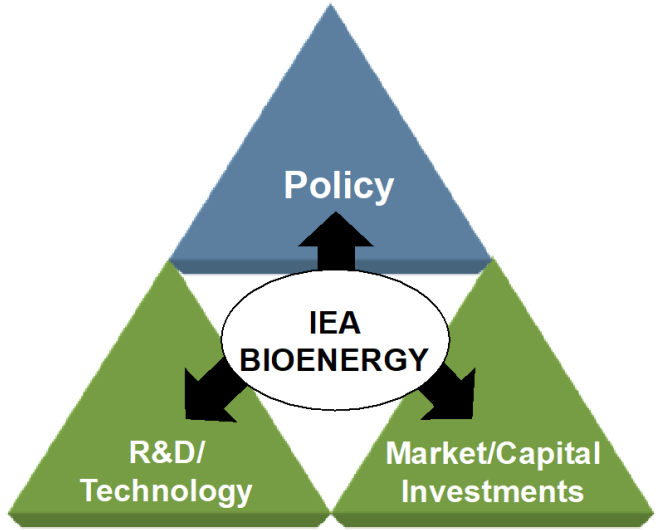
BUT IEA and IEA Bioenergy work closely together, significant collaboration and data exchange

IEA Bioenergy TCP

Aims:

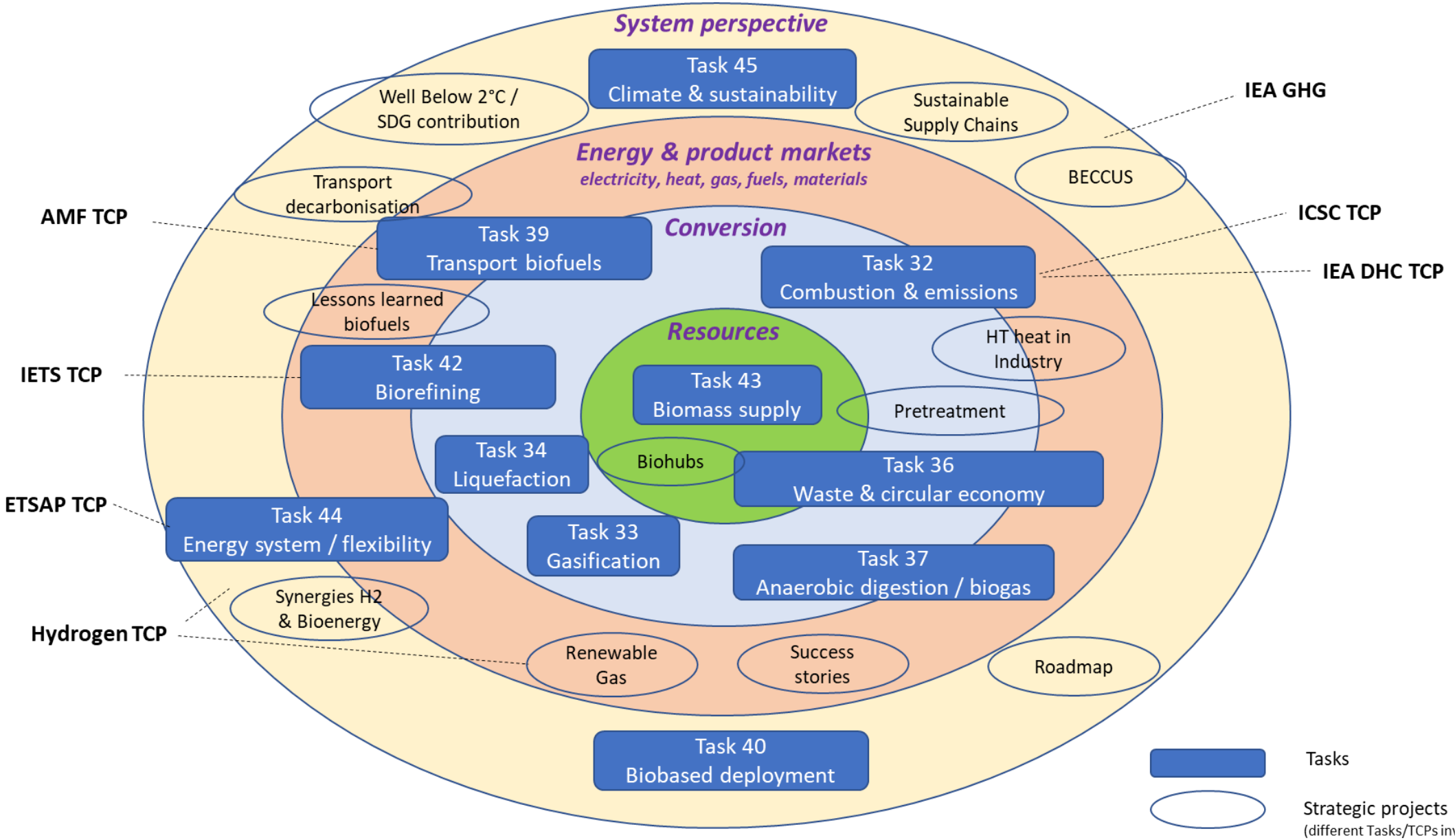
International **collaboration** and **info exchange** on bioenergy;

- Research
- Technology development
- Demonstration
- Policy analysis
- Commercialization and market deployment



Work programme carried out through **Tasks** and **Special Projects**, covering the full value chain from feedstock to final energy product

Tasks / activities in IEA Bioenergy



IEA Bioenergy

26 Contracting parties

Budget in 2021:
~ 2 Million US$ (+~$8M in-kind)

Direct participation:
> 200 persons

Turkey is in the process of joining IEA Bioenergy

US Grains Council in process to become Limited Sponsor

Bioenergy TCP Action Areas: 2020-2025

1. A sustainable system for energy and materials supply with biomass

- Demonstrating the key role of bioenergy in a decarbonising world
- Contribution to Sustainable Development
- Embedding bioenergy into the broader bio-economy
- Incorporating the security, flexibility and stability provided by bioenergy in the future energy systems

2. Innovative Technologies

- Enabling the development and application of innovative technologies (collaboration & best practices)
- Developing advanced biofuels from lignocellulose and waste & consider their role in hard-to-abate transport sectors (aviation, marine, long-distance transport)

Bioenergy TCP Actions: 2020-2025

3. Sustainable Supply Chains

- Mobilize biomass resources through landscape management, reuse of abandoned agricultural lands; sustainable sourcing in agriculture and forestry;
- Support sustainability governance & certification
- Promote market deployment of efficient biobased value chains

4. Operational Optimisation

- Engaging relevant stakeholders in a dialogue & science based analysis to inform political/public debates
- Expanding collaboration with developing economies
- Ensuring the optimal use of communication channels

Bioenergy TCP Dissemination & Outreach

- **Communication plan & follow-up**
- **Website**: The TCP website is the hub to find all information on the Tasks, publications, events, news items https://www.ieabioenergy.com/
- **Social media**: LinkedIn & Twitter *(~4300 followers currently, steadily increasing*) - key to support visibility & dissemination, next to mailings
- **Webinars**: 2 monthly IEA Bioenergy webinars with typically 200-500 online participants – https://www.ieabioenergy.com/iea-publications/webinars/ *(Tasks also organize their own events*)
- **Regular workshops / stakeholder interactions:** several events organized by the Tasks, but also centrally by ExCo (in conjunction with ExCo meetings)
- **Short summaries of Task reports & factsheets**
- **Newsletters**

- **Communication support:** Contract with Communications consultant to reach broader than the 'Bioenergy bubble'

Recent highlights

IEA Bioenergy triannual conference 2021

"The role of biomass in the transition towards a carbon neutral society"

Online, 29 November – 9 December 2021

- 10 technical sessions and 4 panel sessions on central topics feedstock mobilisation/sustainability governance; transport biofuels; green gas; circular economy and industry; and bioenergy in the energy system
- 1200 people (from ~90 countries) participated in one or more sessions

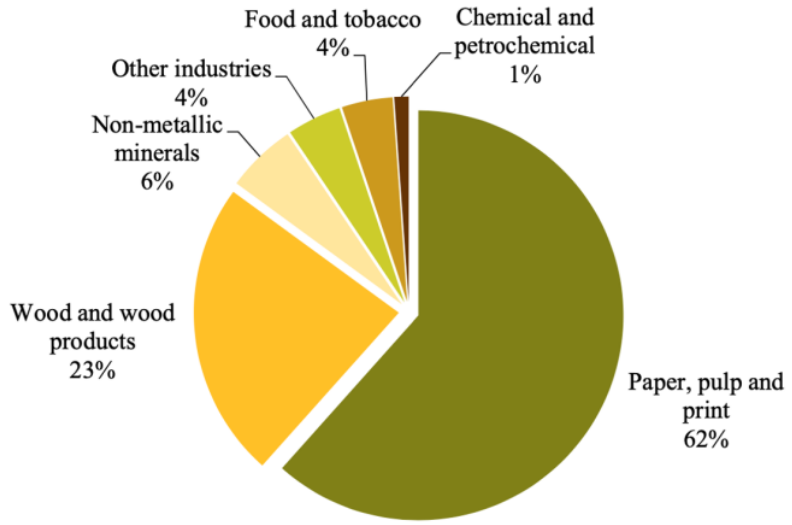
Overview of Speakers and moderators in the conference

IEA Bioenergy triannual conference 2021: Key takeaways

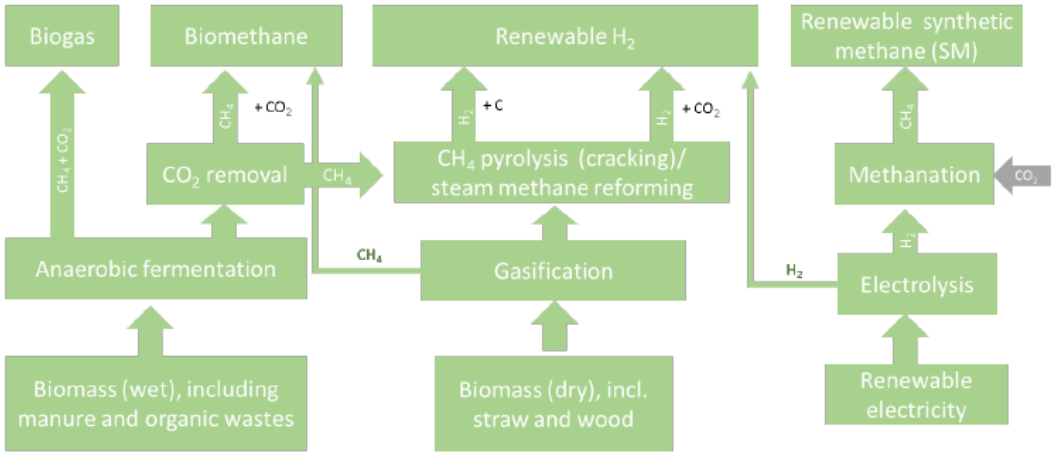
- Bioenergy's role in decarbonisation is substantial; BECCS is one of the critical options to achieve negative emissions
- Bioenergy should not be considered in isolation – it is part of the broader bioeconomy
- Increased efforts needed for sustainable biomass mobilisation; sustainability governance is key
- Transition is accelerating; priorities of biomass use will evolve
- Reliable and coherent political framework conditions needed for the necessary scale-up
- Flexibility is one of the key characteristics of bioenergy; important synergies with hydrogen

Recent Task Reports

- Decarbonizing industrial process heat: the role of biomass (Task 32 and others)
- Emerging gasification technologies for biomass and waste (Task 33)
- Biobased gasoline from sawdust via pyrolysis oil and refinery upgrading (Task 34)
- The role of waste-to-energy and material recycling in circular economy (Task 36)
- Renewable gas – discussion on the state of the industry and its future in a decarbonized world (Task 37)



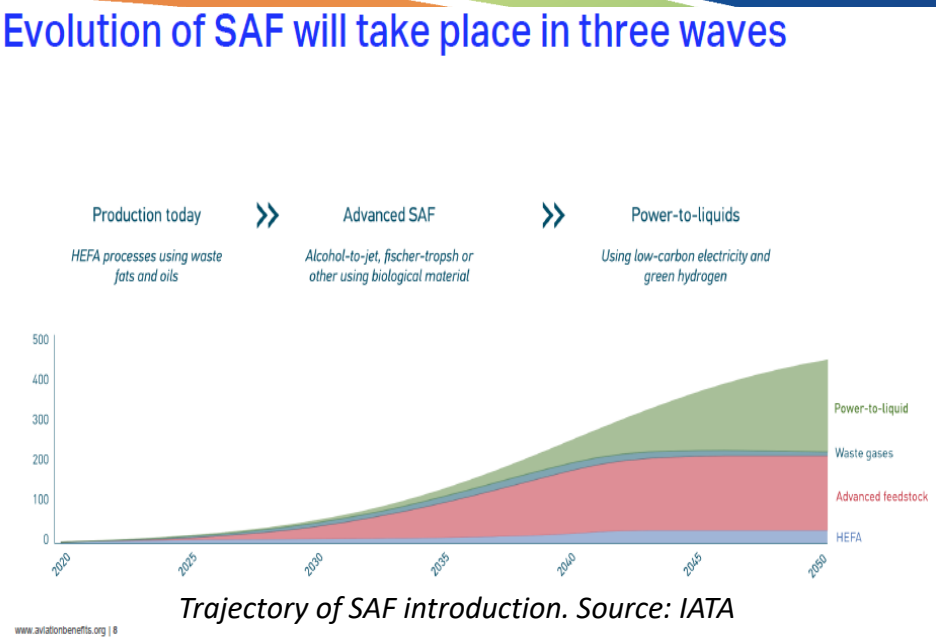
Use of biomass for industrial process heat across different sectors in the EU-28 in 2017



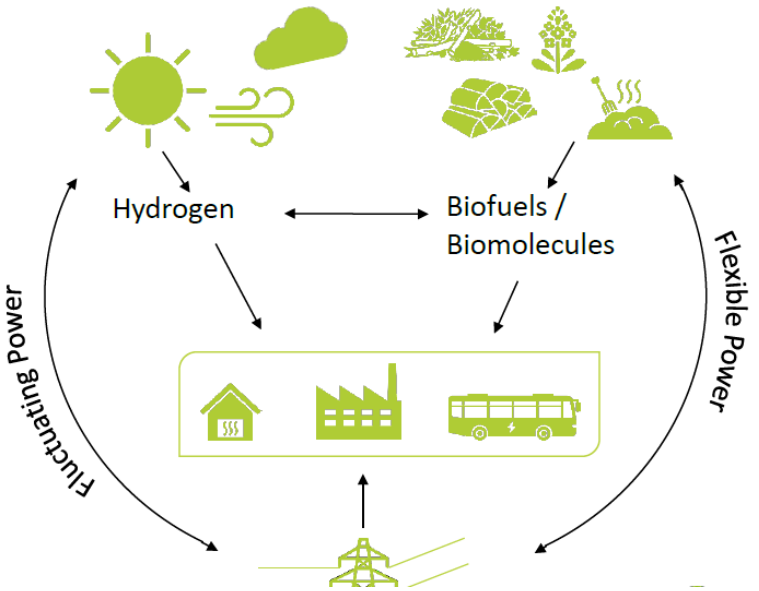
Overview renewable gases. Source: IINAS

Recent Task highlights

- Progress in the commercialisation of biojet / sustainable aviation fuels (Task 39)
- Deployment of bio-CCS: case studies (Task 40 and others)
- Factsheets of biorefinery concepts (Task 42)
- Biomass supply chains and their contribution to Sustainable Development Goals (Task 43 and others)
- Technologies for flexible bioenergy (Task 44)
- Applying a science-based systems perspective to dispel misconceptions about climate effects of forest bioenergy (Task 45)



Trajectory of SAF introduction. Source: IATA



Biomass in the future energy system. Source: DBFZ

Assessing climate impacts: System boundaries matter!

Ignores CO_2 uptake during plant growth

Ignores substitution impacts of GHG intensive fuels/materials

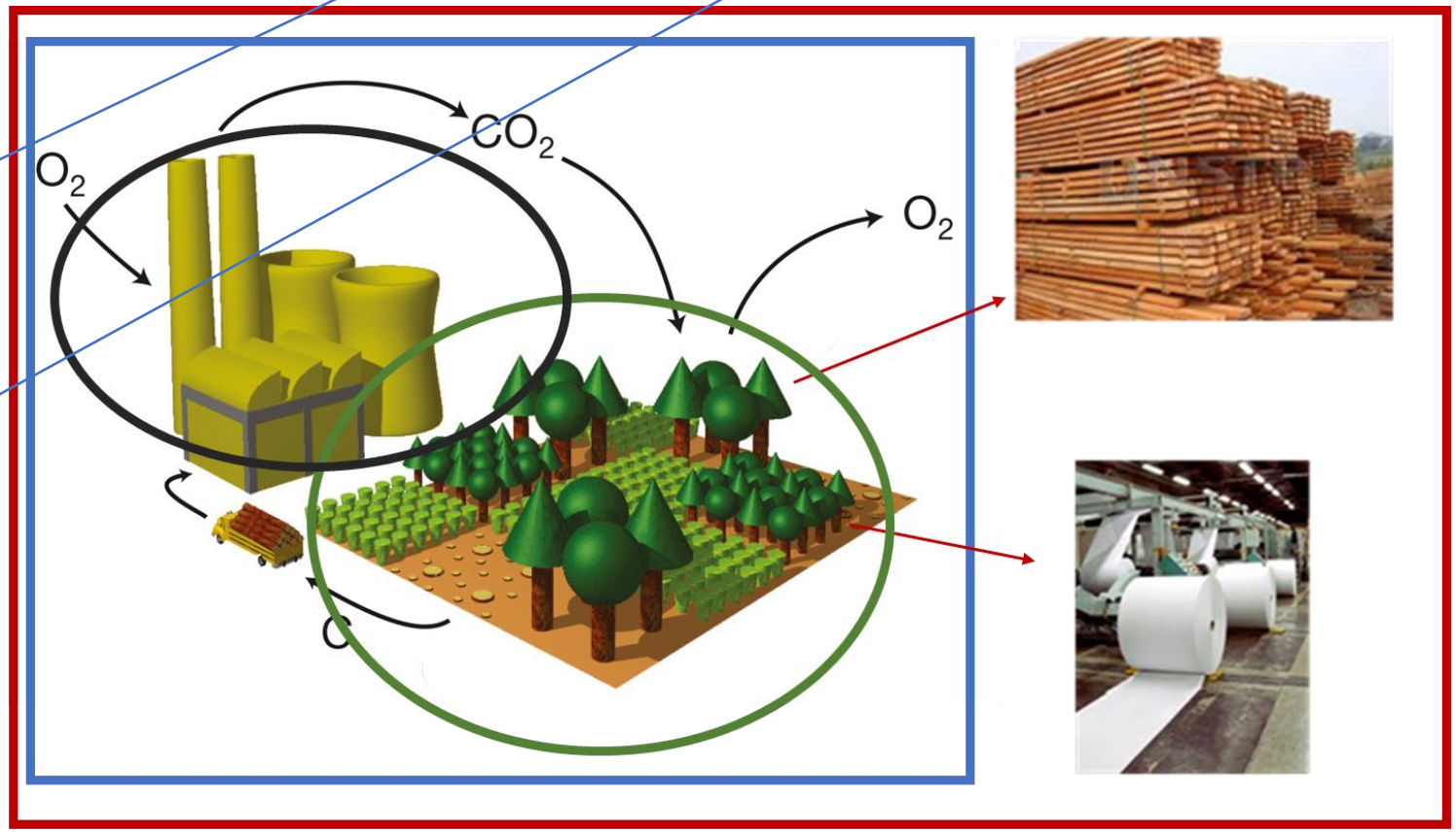
Ignores interaction with forest products

1: The smokestack

2: The forest #stands

3: The bioenergy supply chain

4: The bioeconomy



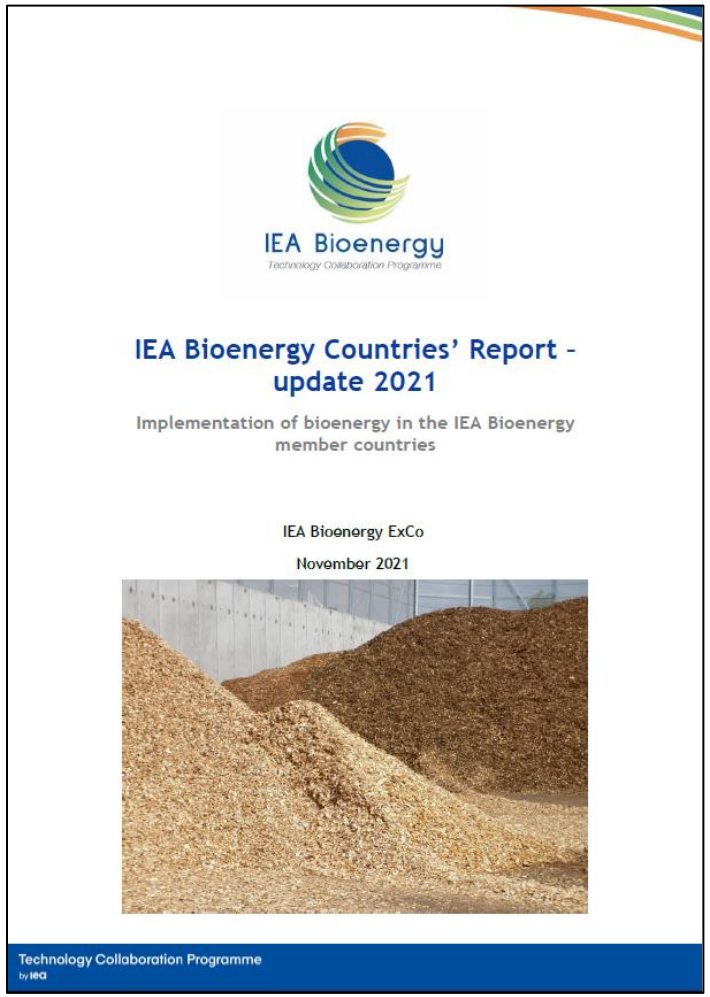
Sustainably management forests contribute to climate change mitigation by providing bioenergy and other forest products that replace GHG-intensive materials and fossil fuels

Strategic Inter-Task projects go beyond focus of individual Tasks & consider the broader picture!

- Bioenergy for high temperature heat in industry
- Deployment of BioCCU/CCS value chains
- Renewable gas - deployment, markets and sustainable trade (incl. H2)
- Assess successes and lessons learned for conventional / advanced biofuels deployment
- The contribution of Advanced Renewable Transport Fuels to transport decarbonisation in 2030 and beyond (*with AMF TCP*)
- The role of bioenergy in a Well-Below-2°C/SDG world

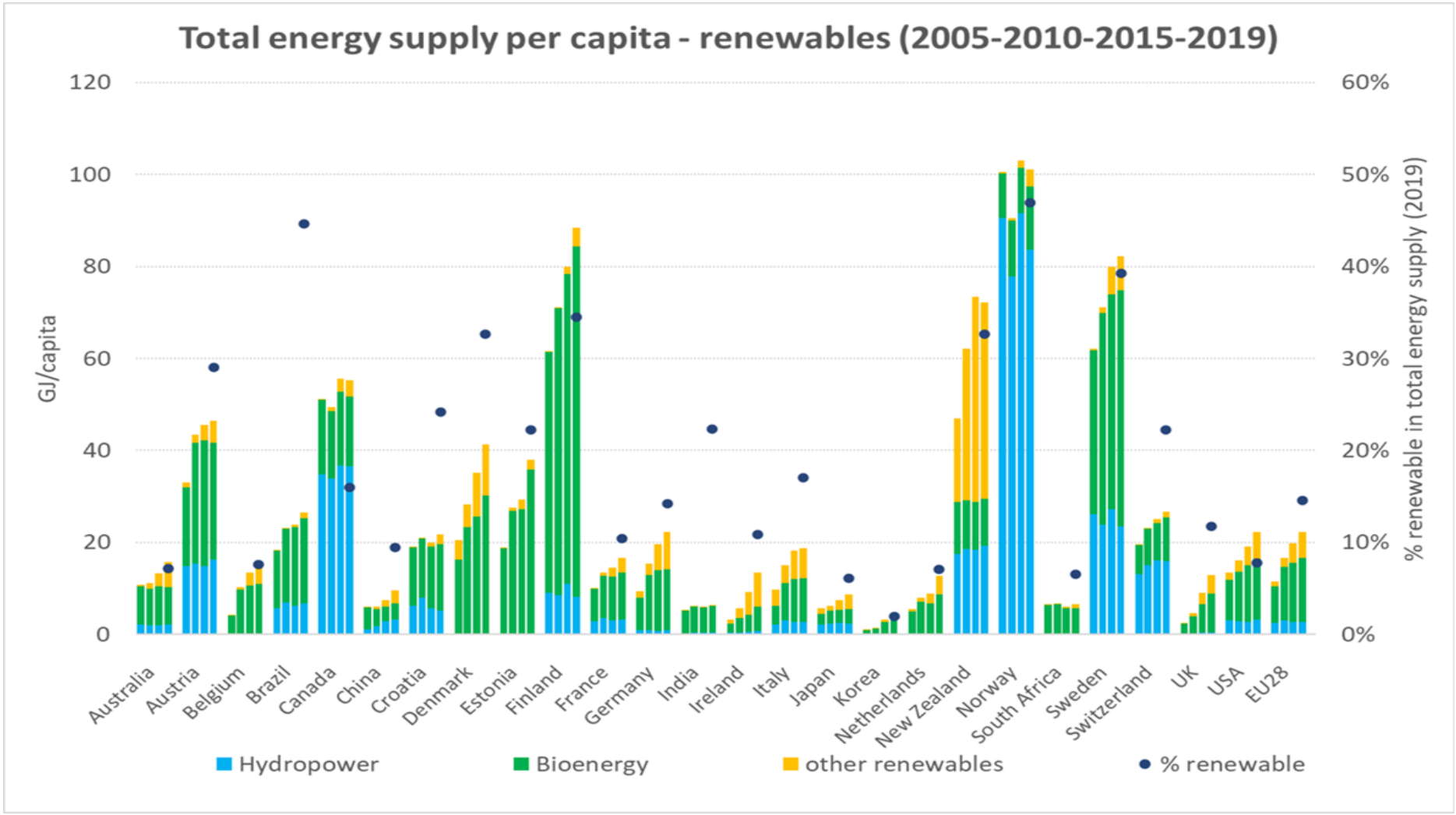
- Recently started:
  - Synergies of green hydrogen and bio-based value chains deployment
  - Management of biogenic CO2 in BioCCU/CCS

2021 Countries Reports – Countries comparison



- Country Profile for each country
- Total Energy Supply by fuel/energy type
- Role of Bioenergy and other renewables by sector
- Policies
- Data sourced from 2021 IEA World Energy Balances and FAOstat (normally from Government Ministries)

Country Comparisons

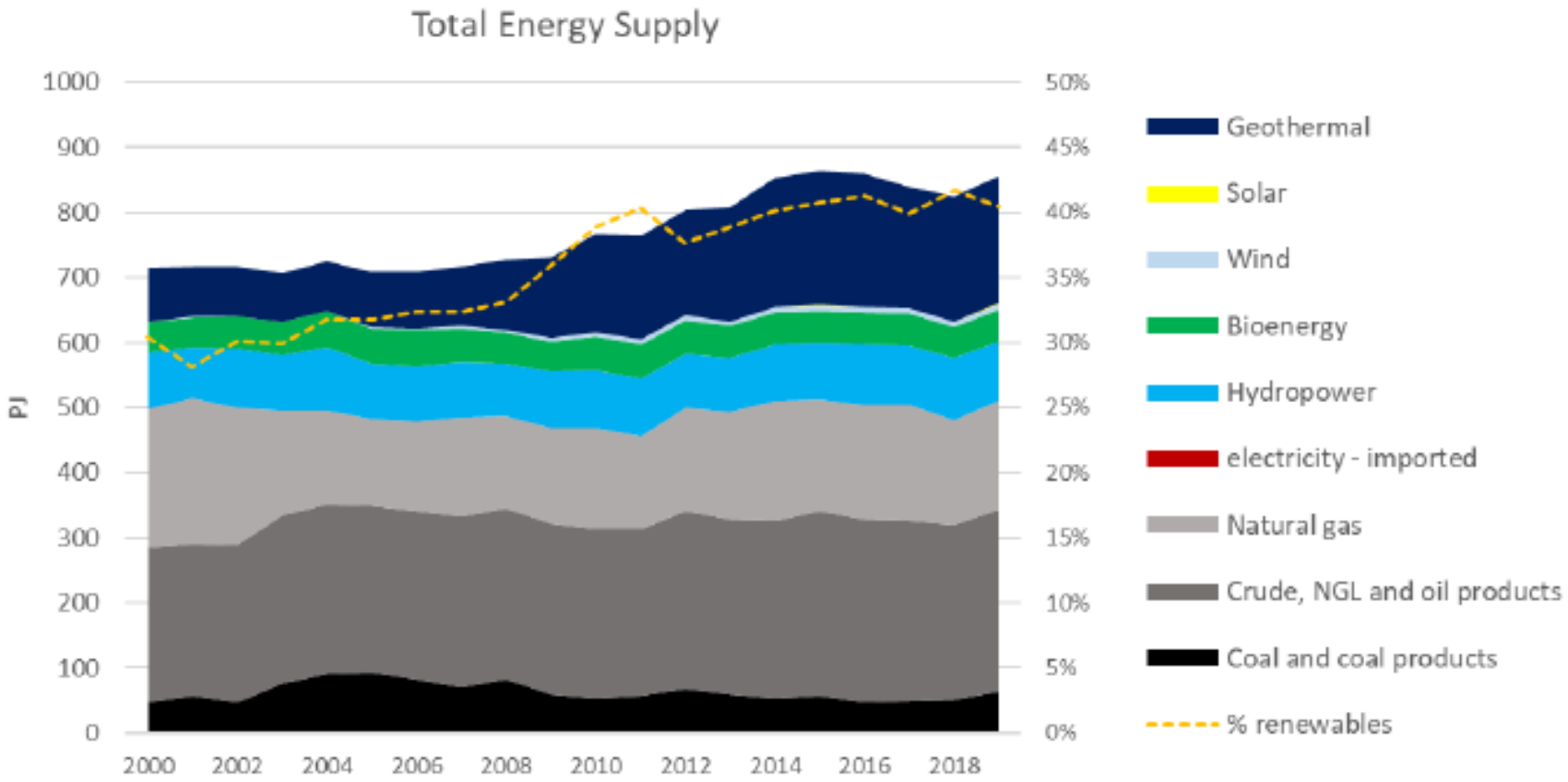


New Zealand Profile - released October 2021

New Zealand Profile - Highlights

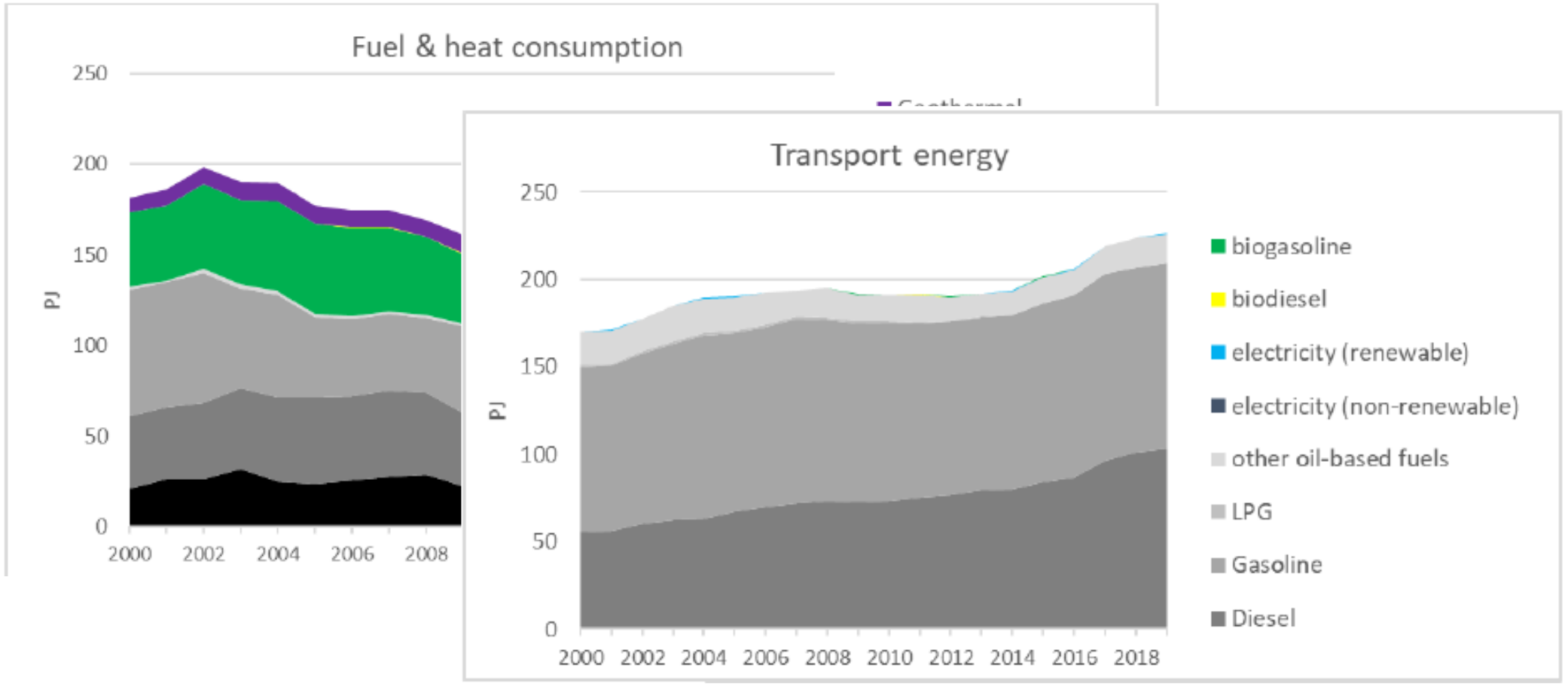
- Renewables make up 40% of total energy supply in 2019
- Hydropower is dominant in electricity followed by geothermal
- New Zealand has high use of transport fuels per capita
- The use of biomass/bioenergy is modest. **Substantial progress possible**
- Liquid Biofuel and energy from MSW is underdeveloped. **High development opportunities**
- Climate Change Act provides framework for the development of clear and stable policies
  - Highlights some recent policy development activities

Role of Bioenergy and Renewables by Sector



Based on IEA World Energy Balances and Renewables Information (2021)

Lots of useful information and figures…..



IEA Bioenergy Conclusions

- Bioenergy has key role to play in the clean energy transition and in the circular bioeconomy
- IEA Bioenergy continues to provide crucial science-based analysis to inform policy makers and other key stakeholders
- Improved methods for disseminating IEA Bioenergy messages are being explored to increase the effectiveness of our communication and the impact of our work
- Collaboration with relevant international bodies (e.g., GBEP and Biofuture Platform) is developing strongly

https://www.ieabioenergy.com/

Thanks for your attention!
Questions?

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